Designing for Quiet Pavements

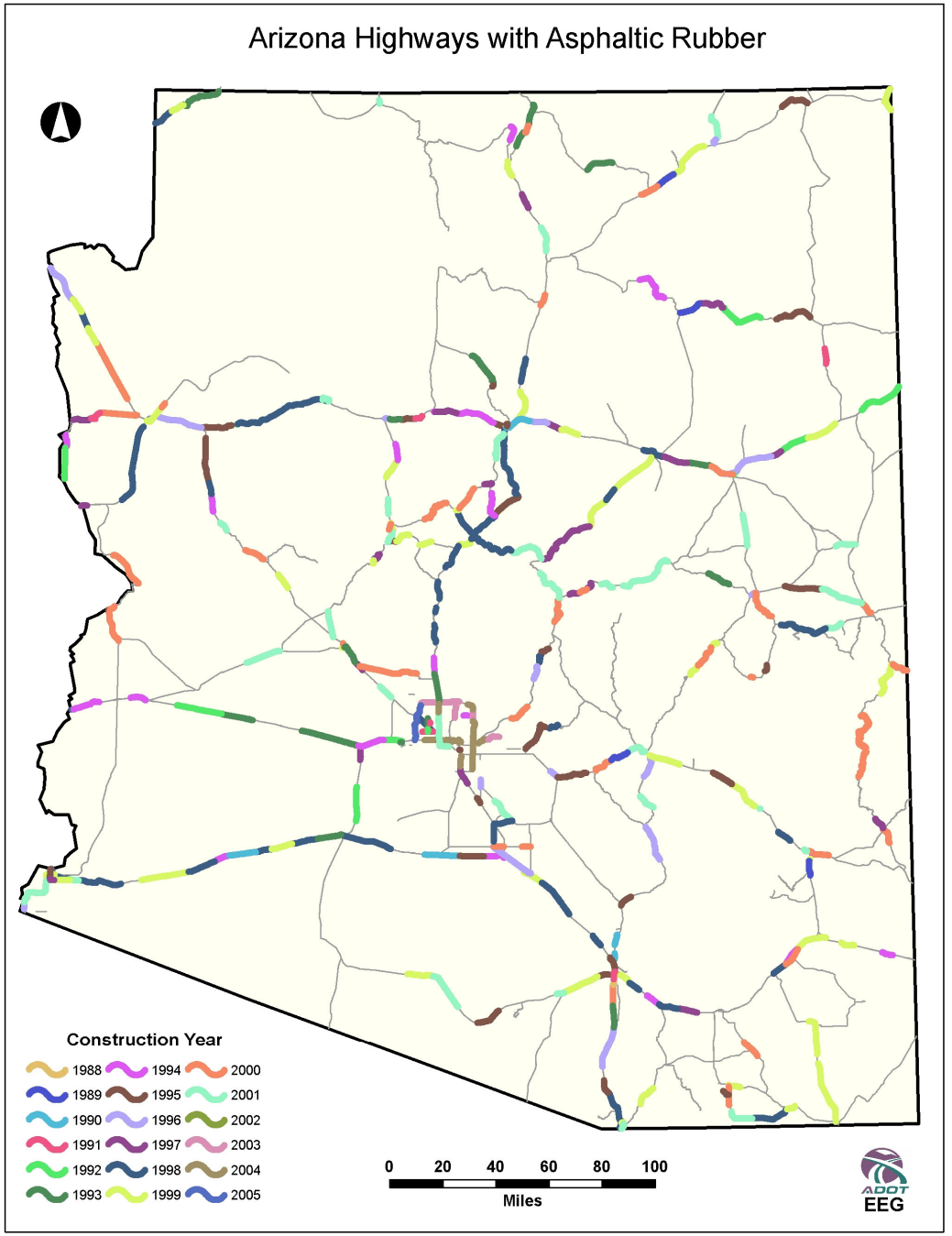
Christ Dimitroplos
Arizona Dept. of Transportation
2739 E. Washington
Phoenix, AZ 85034
Tel: 602/712-7850
e-mail: cdimitroplos@azdot.gov

Pavements In the Past

- C
- CCobble Stone Streets
- GGranite Block Stones Streets
- WWood Block Streets
- SSheet Asphalt Streets
- BBrick Streets
- MMacadam Surface

Background

- ADOT has used ARFC in research since 1976
- ADOT has used ARFC on concrete pavement since 1988
- ADOT formally began research on the noise reduction benefits of ARFC in 1995


Arizona Highways with Asphaltic Rubber
Construction Year
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
0
20
40
60
80
100
Miles
ADOT
EEG

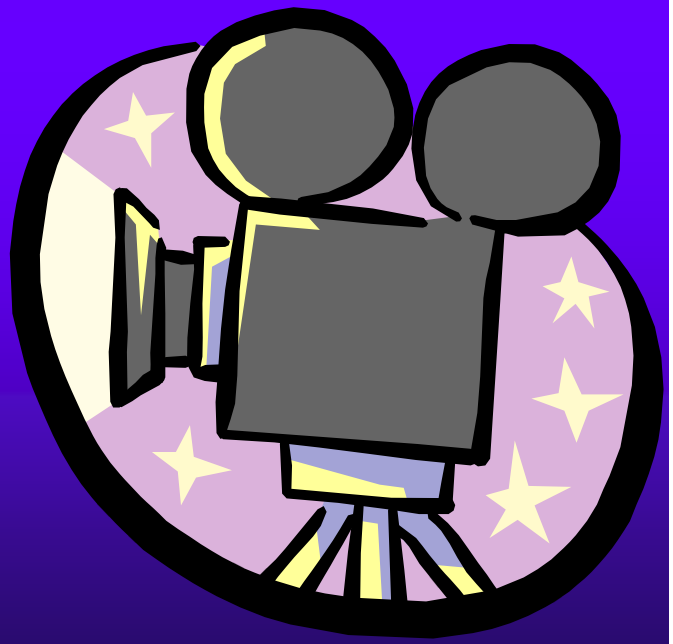
Benefits of ARFC

- Resists rutting under traffic
- Provides a smooth, skid resistant riding surface
- Popular with the public as it reduces noise

Presentation Message---

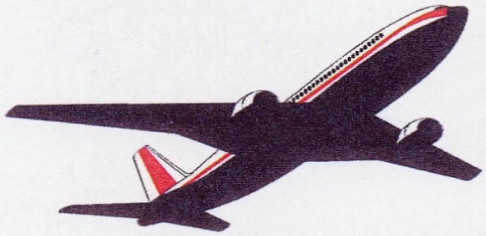
Vehicle Tires Traveling Over the Roadway Surface Produces the Noise You Hear in Your Car and in Your Homes

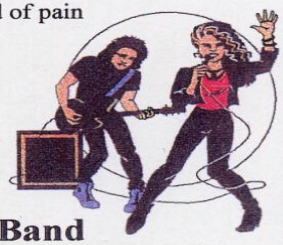
What is Noise, How is it Controlled, and How Does it Affect Our Lives

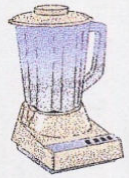


Common Indoor and Outdoor Noise Levels

Common Outdoor Noises	Sound Level (dBA)	Common Indoor Noises
	140	Threshold of pain
	130	
	120	
Jet Flyover at 1000 feet	110	**Rock Band** at 15 feet
Gas Lawn Mower at 3 feet	100	
Diesel Truck at 50 feet	90	**Food Blender** at 3 feet
Urban Daytime	80	Garbage Disposal at 3 feet
Gas Lawn Mower at 100 feet	70	Vacuum Cleaner at 10 feet
Heavy Traffic at 300 feet	60	Normal speech at 3 feet
Typical Urban Daytime	50	Dishwasher next room
Urban Nighttime	40	Library
	30	Bedroom at night
Rural Nighttime	20	
	10	
	0	Threshold of hearing

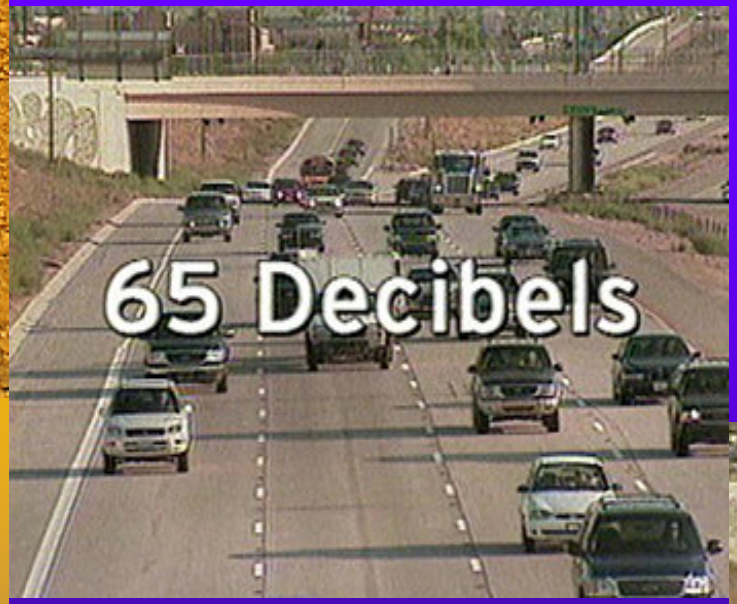


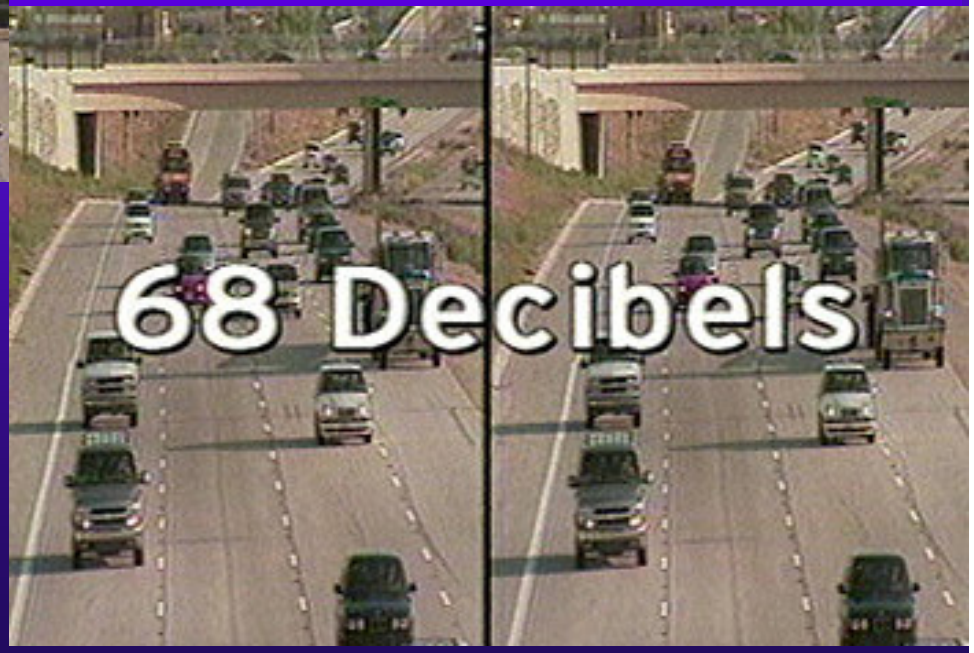




Note: ***Sound is preceived differently by every individual***

Doubling Traffic adds 3dBA

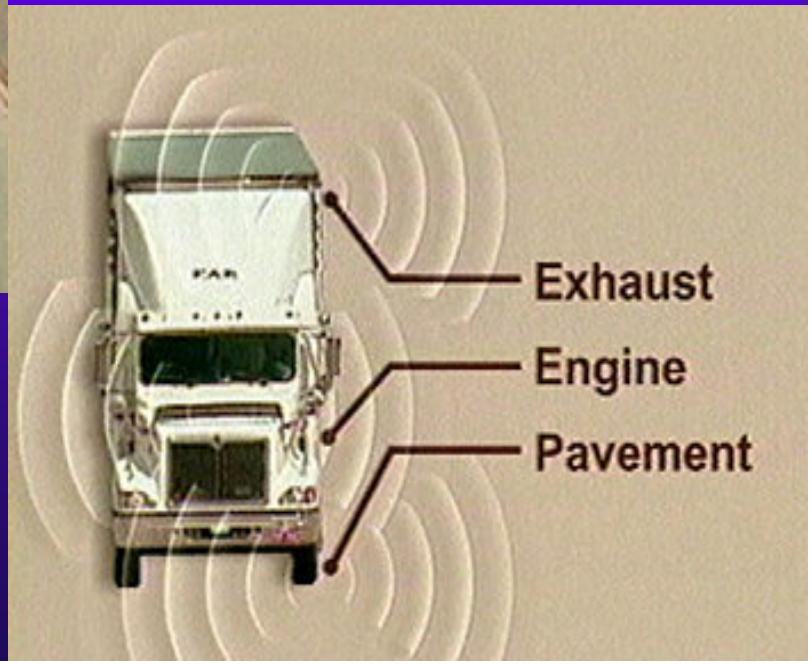




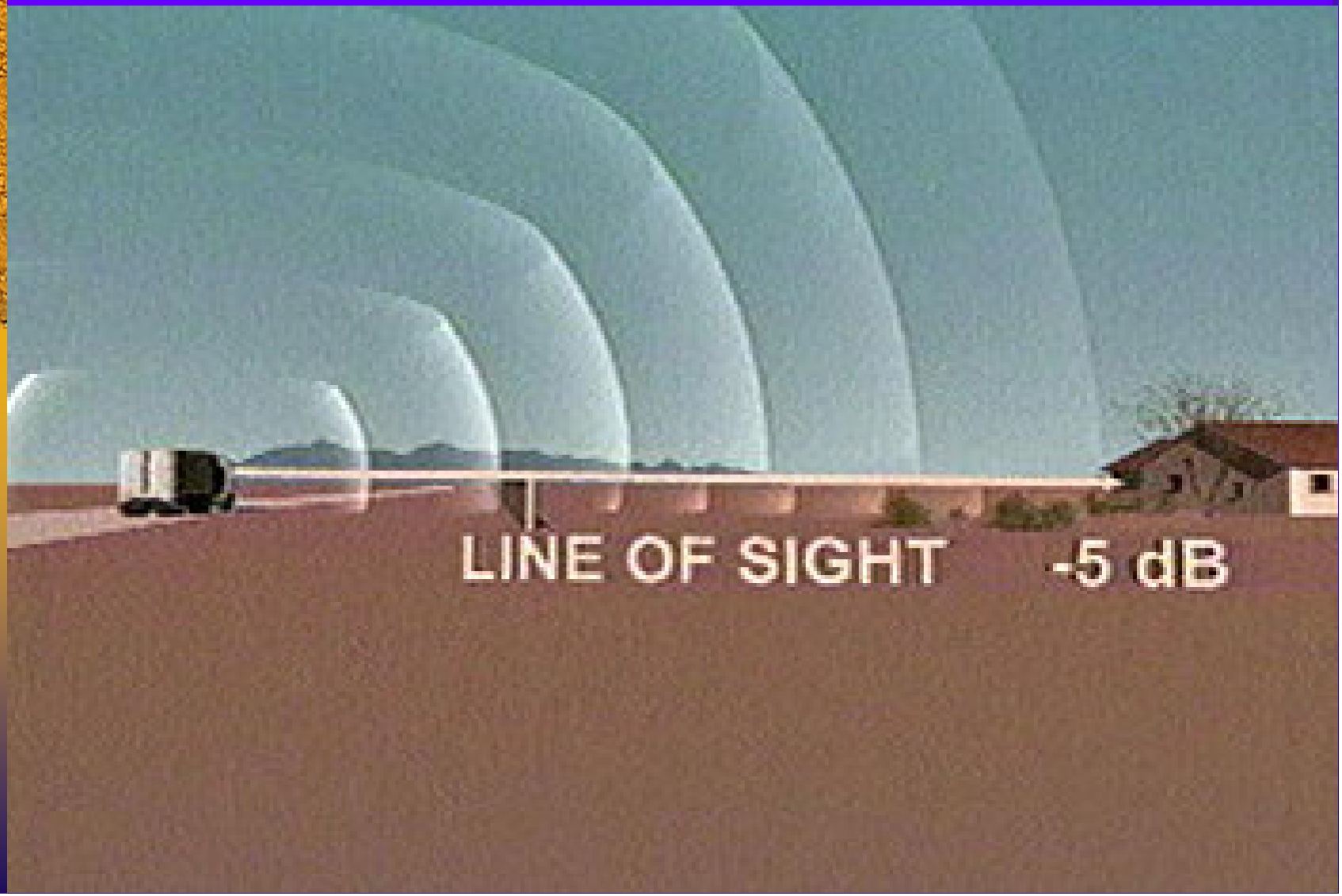
How Is It Controlled

- At the Source
  - Vehicle & Tire/Pavement Interface
- Through Distance
  - 3 dBA Reduction for Each Doubling of Distance
  - 25ft=70dBA, 50ft=67dBA, 100 ft=64
- Through Barriers
  - Berms, Walls, And Combination of both

Controlled At the Source



Controlled Through Barriers
1 dBA for each 2 ft of Wall



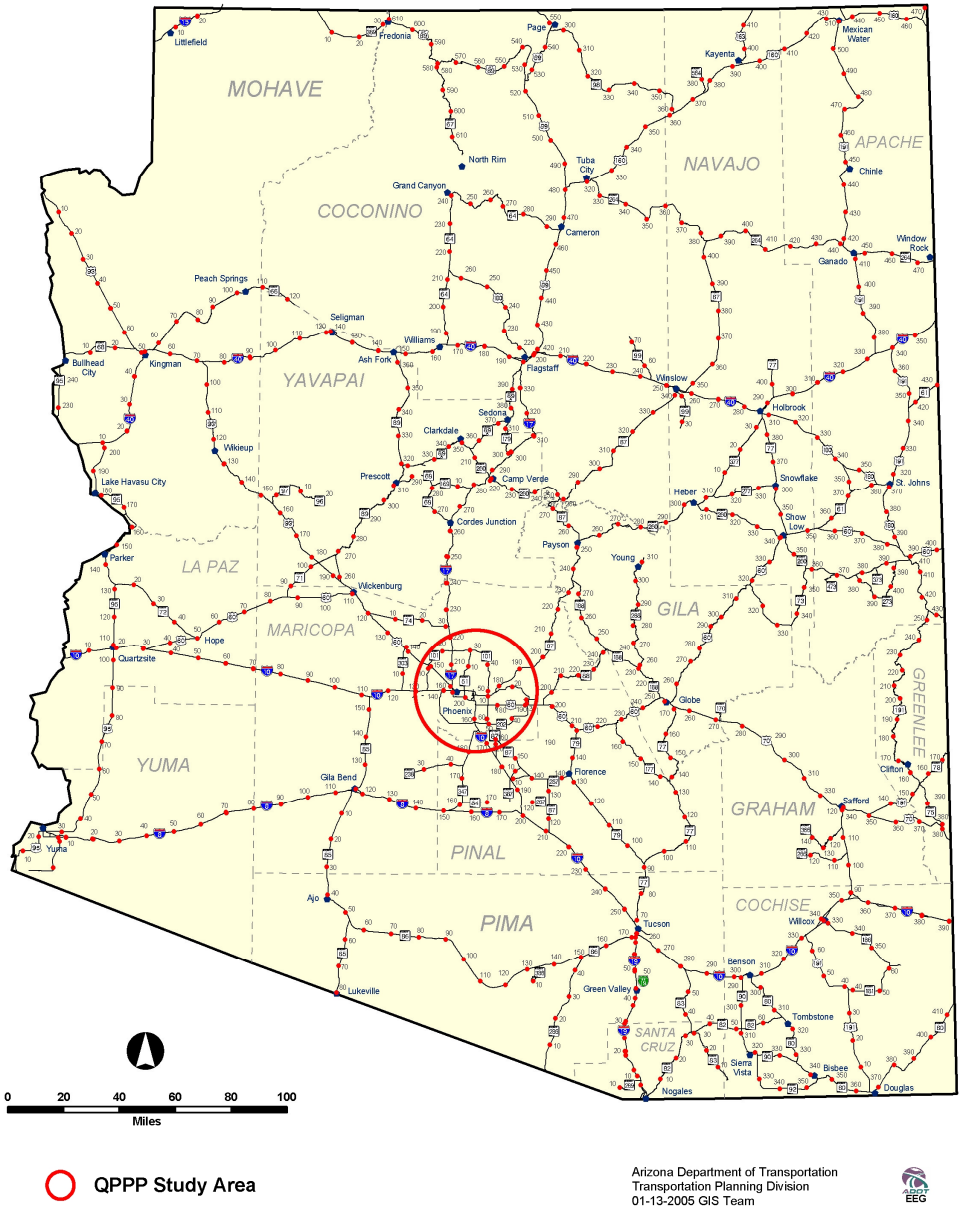
How does it affect our lives

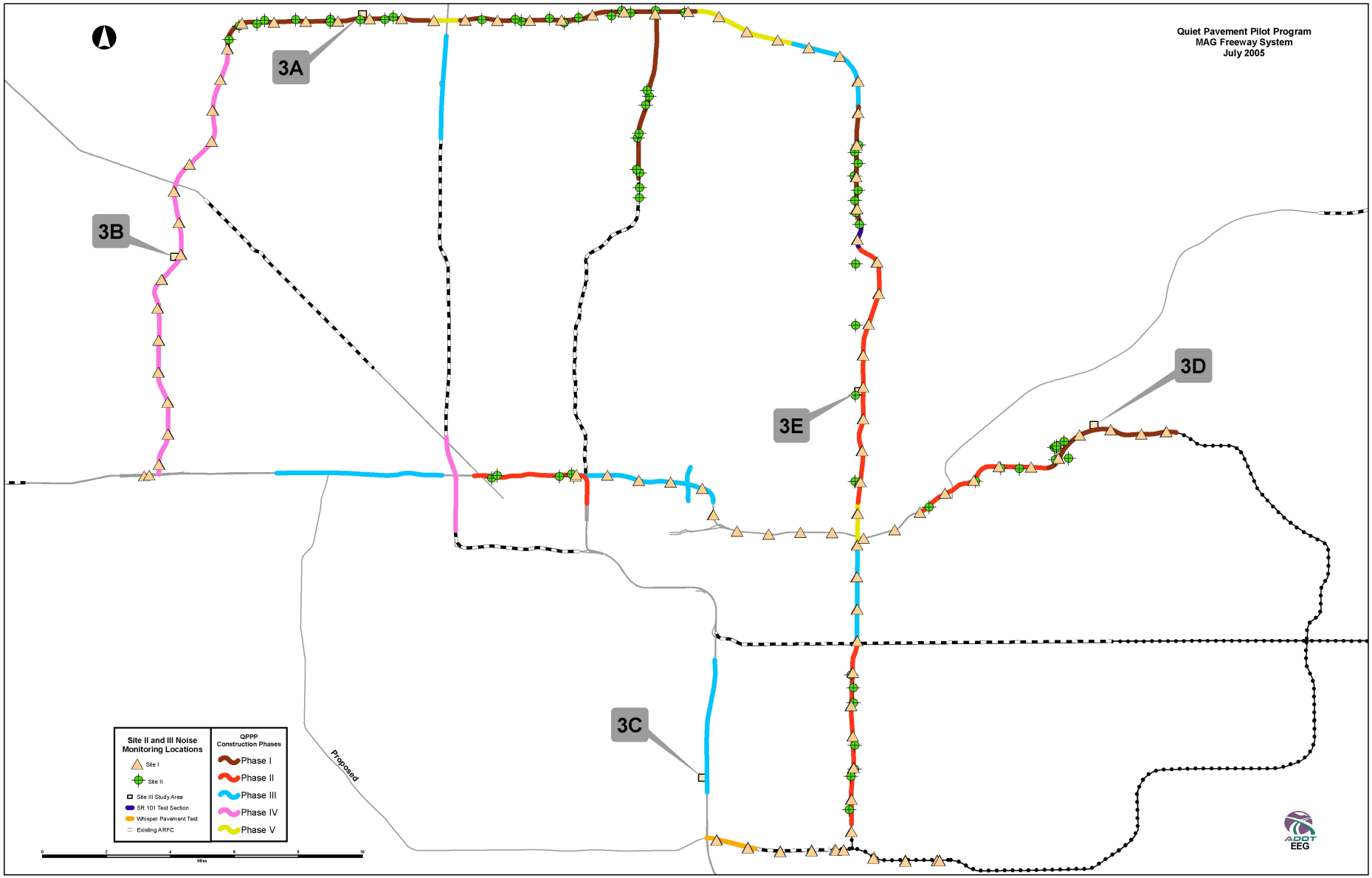
- Disrupts recreational activity
- Diminishes the quality of life in a community
- May require expensive mitigation measures such as sound walls.

Types of Noise Measurements

- Site 1 measures noise at the tire/pavement interface
- Site 2 measures noise in residential neighborhoods
- Site 3 measures noise between near field and far field

QPPP Location Map




Quiet Pavement Pilot Program
MAG Freeway System
July 2005
3A
3B
3C
3D
3E
Site II and III Noise Monitoring Locations
Site I
Site II
Site III Study Area
SR 101 Test Section
Whisper Pavement Test
Existing ARFC
QPPP Construction Phases
Phase I
Phase II
Phase III
Phase IV
Phase V
Proposed
Miles
ADOT EEG

Ways of Measuring Sound

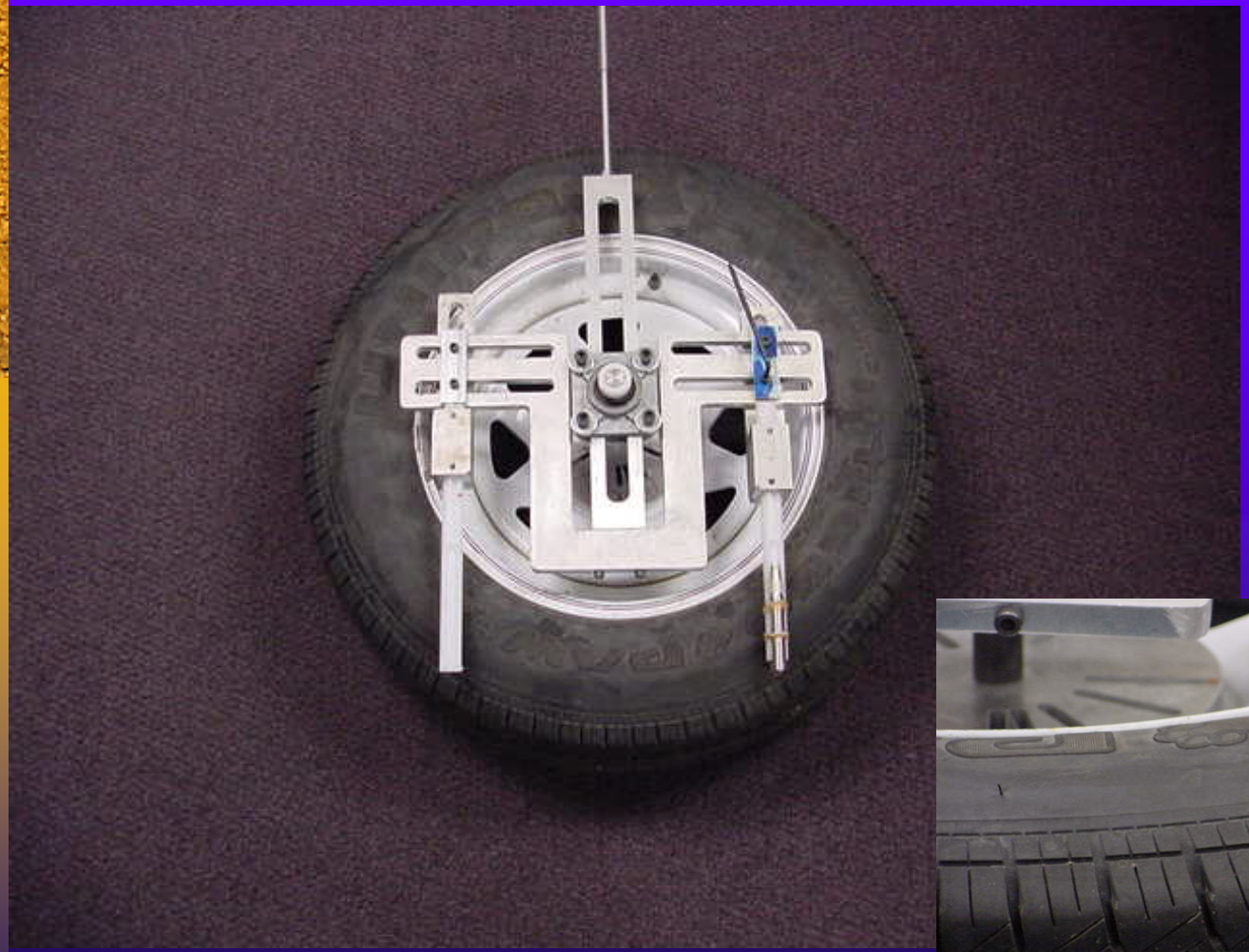
Close Proximity (Near Field)

Noise Intensity (Near Field)

Wayside (Far Field)

ADOT ISO CPX Trailer

Noise Intensity

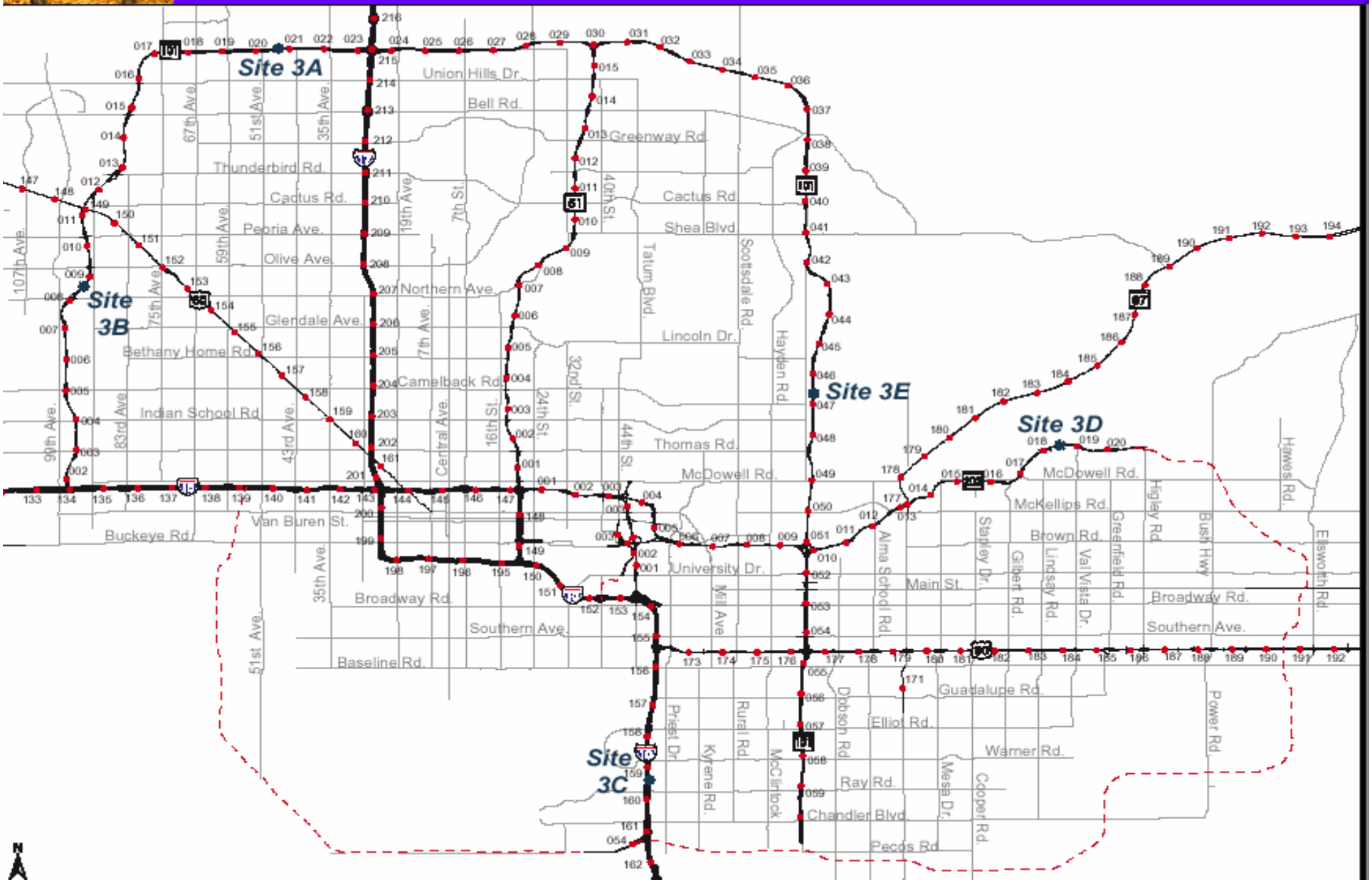


In The Present

- Historically pavement surface type has not been recognized as a Noise Mitigation Strategy by the FHWA

- ADOT has committed to both short term and long term monitoring of ARFC surface treatment as a noise mitigation strategy

Quiet Pavement Pilot Program

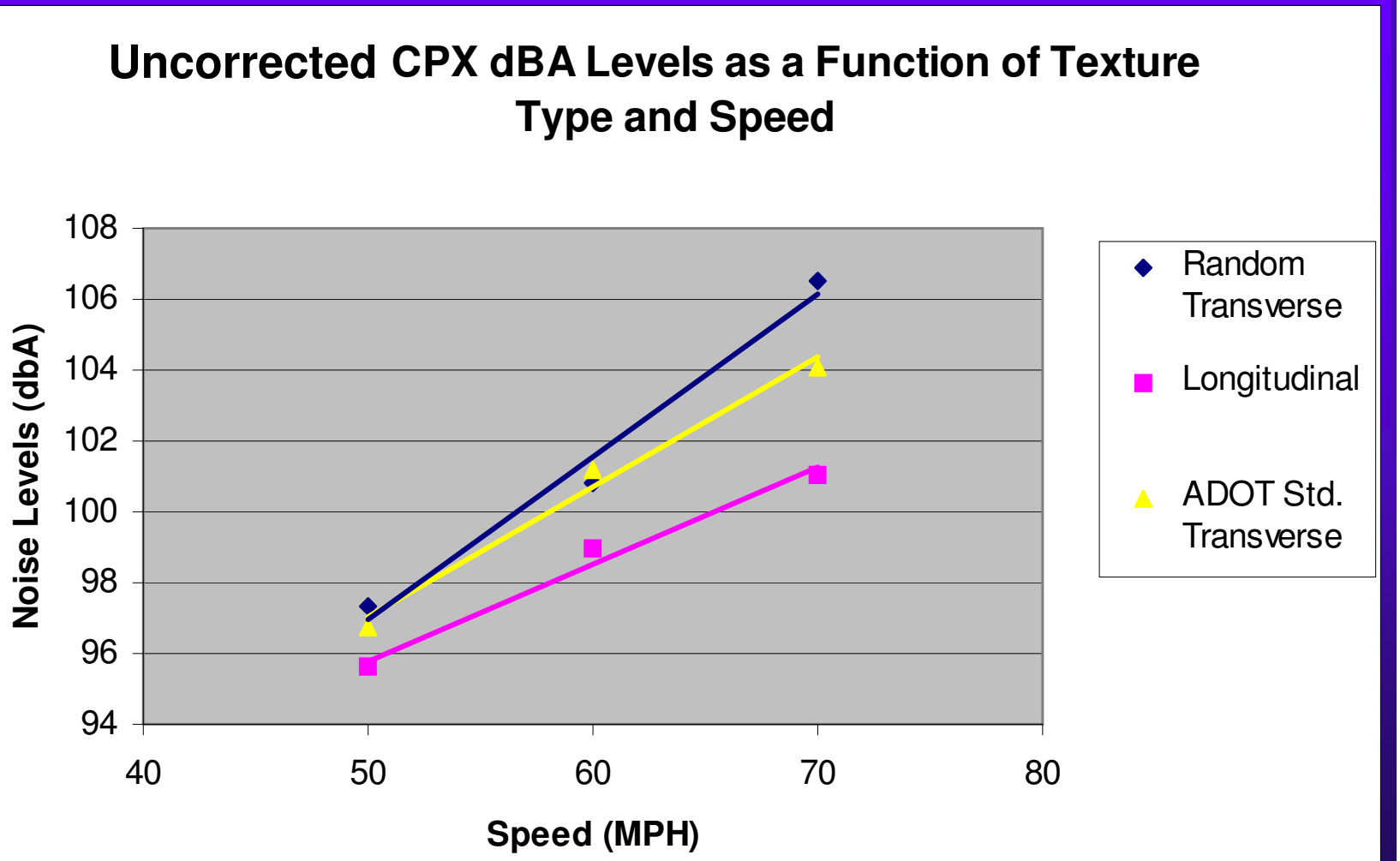


Concrete Textures

- Uniform Transverse Texture
- Random Transverse Texture
- Longitudinal Texture

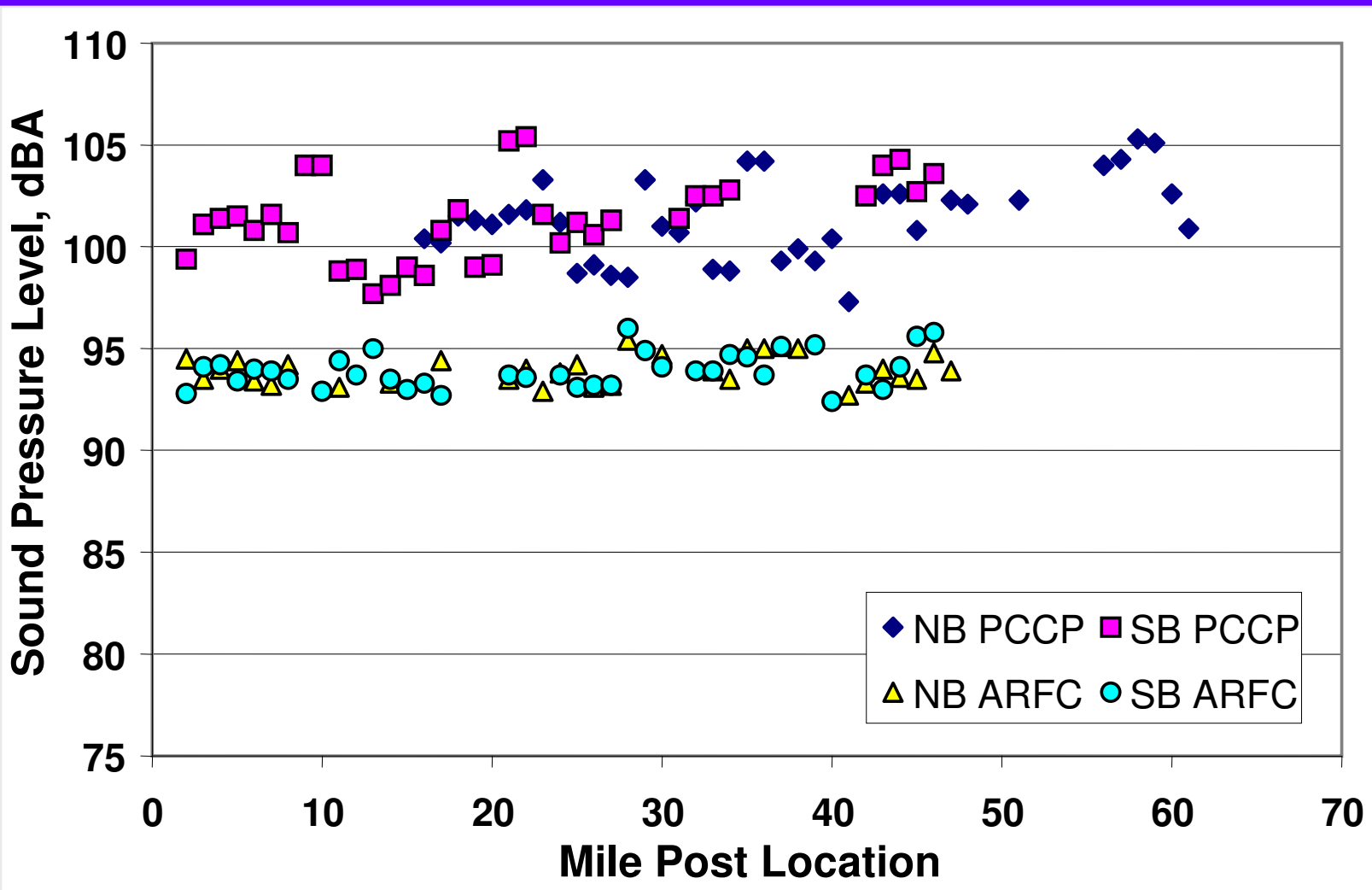
Evaluated Three Tining Types

CPX Noise Levels as a Function of Texture Type and Speed



Site 1 CPX Results on SR101

North & South Bound Directions

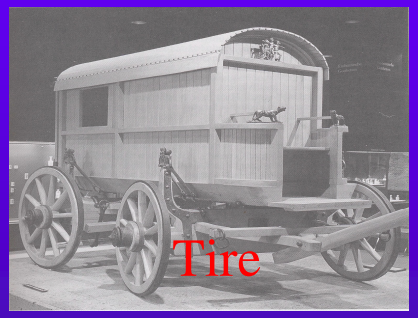


In Summary

- Surface Type Does Matter
- Noise Should be Managed Just Like Friction, Roughness, Rutting, and Cracking
- **It's a Quality of Life Issue!!!**

Thank You

6,000 Yrs



100 Yrs

Future